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Mani Adeli

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application for:

Steven Teig

Serial No.:

Filing Date: 1/5/02

For: ROUTING METHOD AND APPARATUS

Examiner: <not assigned yet>

Group Art Unit: <not assigned yet>

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PRELIMINARY AMENDMENT

Assistant Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

This Preliminary Amendment is concurrently filed with the above-entitled application, which is a continuation application of a presently pending application entitled "Routing Method and Apparatus that Utilize Diagonal Routes," filed on December 7, 2001, and having serial number 10/013,819. **Applicants respectfully request that claims 1-26 be canceled (pursuant to the amendment below) before calculation of the filing fee**.

Please amend the application as follows:

IN THE TITLE

Please replace the current title, "ROUTING METHOD AND APPARATUS THAT UTILIZE DIAGONAL ROUTES," with "ROUTING METHOD AND APPARATUS."

IN THE SPECIFICATION

Please delete the "Claim of Benefit to Prior Application" on page 1, lines 1-11, and insert therein a new Claim of Benefit to Prior Applications as follows:

--CLAIM OF BENEFIT TO PRIOR APPLICATIONS

This application is a continuation application of United States Patent Application entitled "Routing Method and Apparatus that Utilizes Diagonal Routes," filed on December 7, 2001, and having serial number 10/013,819. This patent application also claims the benefit of the earlier-filed U.S. Provisional Patent Application entitled "Routing Method and Apparatus", having serial number 60/314,580, and filed 8/23/2000; and U.S. Provisional Patent Application entitled "Routing Method and Apparatus", having serial number 60/337,504, and filed 12/6/2001--

Please delete the "Field of the Invention" on page 1, lines 10-12, and insert therein a new Field of the Invention as follows:

--FIELD OF THE INVENTION

The invention is directed towards a routing method and apparatus.--

On page 5, lines 1-8, please delete the "Summary of the Invention", and insert therein a new Summary of the Invention as follows:

--SUMMARY OF THE INVENTION

Some embodiments provide a method of routing a net within a region of an integrated-circuit ("IC") layout. For the net, the method initially identifies a route that uses a first path within the region. The first path shares a common region in the IC region with a set of adjacent paths. The set of adjacent paths includes at least one path and each path in the set is adjacent to the first path. After identifying the route, the method then determines whether embedding the route in the region will cause congestion about the first path and the set of paths to exceed a threshold value. If so, the method discards the route in some embodiments of the invention.--

IN THE CLAIMS

Please cancel claims 1-26.

Please add the following claims 27-57.--

27. (New) A method of routing a net within a region of an integrated-circuit ("IC") layout, the method comprising:

a) for the net, identifying a route that uses a first path within the region, wherein the first path shares a common region in the IC region with a set of adjacent paths, wherein said set has at least one path and each path in the set is adjacent to the first path;

b) determining whether embedding the route in the region will cause congestion about the first path and the set of paths to exceed a threshold value.

28. (New) The method of claim 27 further comprising selecting the route if embedding the route does not cause the congestion about the paths to exceed the threshold value.

29. (New) The method of claim 27 further comprising discarding the route if embedding the route causes the congestion about the paths to exceed the threshold value.

30. (New) The method of claim 27, wherein congestion along the paths includes wireflow along the paths.

31. (New) The method of claim 30, wherein congestion along the paths further includes blockages of the paths.

32. (New) The method of claim 27, wherein the set of paths includes a second path, and the threshold value equals the sum of the routing capacities of the first and second paths minus the routing capacity shared between the first and second paths.

33. (New) The method of claim 32, wherein the first and second paths are diagonal paths that are defined on one routing layer.

34. (New) The method of claim 33, wherein the first and second paths are in the same direction.

35. (New) The method of claim 27, wherein the set of paths includes a second path and a third path, and the threshold value equals routing capacity of the first, second, and third paths minus the routing capacity shared among of the first, second, and third paths.

36. (New) The method of claim 35, wherein the first, second, and third paths are diagonal paths that are defined on one routing layer.

37. (New) The method of claim 36, wherein the first, second, and third paths are in the same direction.

38. (New) The method of claim 27, wherein the set of paths includes a second path and a third path, wherein the first and second paths are diagonal paths, and the third path is a Manhattan path, wherein the third Manhattan path represents wireflow in the Manhattan and diagonal directions, wherein the threshold value equals routing capacity of

the first, second, and third paths minus the routing capacity shared among of the first, second, and third paths.

39. (New) The method of claim 27, wherein the set of paths includes second, third, fourth, and fifth adjacent paths, wherein the first through fourth paths are diagonal paths, and the fifth path is a Manhattan path, wherein the fifth path represents wireflow in the Manhattan and diagonal directions, wherein the threshold value equals routing capacity of the first through fifth paths minus the routing capacity shared among of the first through fifth paths.

40. (New) The method of claim 27, wherein said determination of whether to embed the route is formulated as a constraint of a linear programming problem.

41. (New) A method of routing nets within a region of an integrated-circuit ("IC") layout, the method comprising:

a) partitioning the IC region into a plurality of sub-regions, wherein a plurality of paths exist between the sub-regions, each path representing a plurality of routing tracks, and at least a first path shares routing tracks with a set of paths;

b) for the net, identifying a route that uses the first path;

c) determining whether to embed the route at least partially based on the number of tracks available along the first path and the set of paths.

42. (New) The method of claim 41, wherein the number of available tracks equals the number of tracks along the first path and along the set of paths minus the number of tracks shared between the first path and the set of paths minus the number of tracks used and blocked along the first path and the set of paths.

43. (New) The method of claim 42, wherein the number of tracks available along the first path and the set of paths is not the only criteria for determining whether to embed the route.

44. (New) The method of claim 41, wherein the set of paths includes a second path that represents routing tracks on a routing layer that also includes at least some of the routing tracks of the first path.

45. (New) The method of claim 44, wherein the first and second paths are diagonal paths that are in the same direction.

46. (New) The method of claim 44, wherein the first path is a diagonal path and the second path is a Manhattan path.

47. (New) The method of claim 41, wherein the set of paths includes a second path and a third path, wherein the first, second, and third paths are diagonal paths that are in the same direction and that are defined on one routing layer.

48. (New) The method of claim 41, wherein the set of paths includes a second path and a third path, wherein the first and second paths are diagonal paths, and the third

path is a Manhattan path, wherein the third Manhattan path represents a plurality of tracks in the Manhattan and diagonal directions.

49. (New) The method of claim 41, wherein the set of paths includes second, third, fourth, and fifth paths, wherein the first through fourth paths are diagonal paths, and the fifth path is a Manhattan path, wherein the fifth path represents a plurality of tracks in the Manhattan and diagonal directions.

50. (New) A computer readable medium comprising a computer program having executable code, the computer program for routing a net within a region of an integrated-circuit ("IC") layout, the computer program comprising:

a) a first set of instructions for identifying a route for the net, said route using a first path within the region, wherein the first path shares a common region in the IC region with a set of adjacent paths, wherein said set has at least one path and each path in the set is adjacent to the first path;

b) a first set of instructions for determining whether embedding the route in the region will cause congestion about the first path and the set of paths to exceed a threshold value.

51. (New) The computer readable medium of claim 50 further comprising a third set of instructions for discarding the route when embedding the route causes the congestion about the paths to exceed the threshold value.

52. (New) The computer readable medium of claim 50, wherein congestion along the paths includes wireflow along the paths.

53. (New) The computer readable medium of claim 52, wherein congestion along the paths further includes blockages of the paths.

54. (New) The computer readable medium of claim 50, wherein the set of paths includes a second path, and the threshold value equals the sum of the routing capacities of the first and second paths minus the routing capacity shared between the first and second paths.

55. (New) The computer readable medium of claim 50, wherein the set of paths includes a second path and a third path, and the threshold value equals routing capacity of the first, second, and third paths minus the routing capacity shared among of the first, second, and third paths.

56. (New) The computer readable medium of claim 50, wherein the set of paths includes a second path and a third path, wherein the first and second paths are diagonal paths, and the third path is a Manhattan path, wherein the third Manhattan path represents wireflow in the Manhattan and diagonal directions, wherein the threshold value equals routing capacity of the first, second, and third paths minus the routing capacity shared among of the first, second, and third paths.

57. (New) The computer readable medium of claim 50, wherein the set of paths includes second, third, fourth, and fifth adjacent paths, wherein the first through

fourth paths are diagonal paths, and the fifth path is a Manhattan path, wherein the fifth path represents wireflow in the Manhattan and diagonal directions, wherein the threshold value equals routing capacity of the first through fifth paths minus the routing capacity shared among of the first through fifth paths.--

IN THE ABSTRACT

On page 175, lines 1-8, please delete the "Abstract of the Invention", and insert therein a new Abstract of the Invention as follows:

--ABSTRACT OF THE INVENTION

Some embodiments provide a method of routing a net within a region of an integrated-circuit ("IC") layout. For the net, the method initially identifies a route that uses a first path within the region. The first path shares a common region in the IC region with a set of adjacent paths. The set of adjacent paths includes at least one path and each path in the set is adjacent to the first path. After identifying the route, the method then determines whether embedding the route in the region will cause congestion about the first path and the set of paths to exceed a threshold value. If so, the method discards the route in some embodiments of the invention.--

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REMARKS

This Preliminary Amendment is concurrently filed with the above-entitled application, which is a continuation application of a presently pending application entitled "Routing Method and Apparatus that Utilizes Diagonal Routes," filed on December 7, 2001, and having serial number 10/013,819. In this Preliminary Amendment, Applicants have changed the title of this application, inserted a reference to the related parent application, canceled claims 1-26, added claims 27-57, and replaced the Summary and Abstract. Accordingly, claims 27-57 are currently pending in this application.

Respectfully submitted,

STATTLER, JOHANSEN & ADELI LLP

Dated:1/5/02

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